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• De Kruif, Aart  
9051 Afsnee (BE)  
• Van Soom, Ann  
9930 Zomergem (BE)

(71) Applicant: UNIVERSITEIT GENT  
9000 Gent (BE)

(74) Representative:  
Brants, Johan Philippe Emile et al  
De Clercq, Brants & Partner cv  
Edgard Gevaertdreef 10a  
9830 Sint-Martens-Latem (BE)

(72) Inventors:  
• verberckmoes, Steven  
9200 Grembergen (BE)

### (54) Device and method for artificial insemination of bovines and other animals

(57) The invention relates to an artificial insemination device for the insemination of bovines and other animals comprising three hollow and essentially cylindrical tubular elements, each element is provided with an open proximal and a open distal end, said three elements being:

an outer protective sheath,  
an inner sheath and a semen tube, and  
a semen tube,

whereby the diameter of said elements is such that the inner sheath is axial movably in the outer protective sheath and the semen tube is axial movably in the inner

sheath, whereby the length of the outer sheath is less than the length of the inner sheath.

The invention further relates to an outer sheath, an inner sheath and a semen tube for use in an AI device and to a method for the insemination of bovines and other animals, comprising the steps of inserting through the cervix and into the uterine horn, a closed tubular element to a point near the major curve of the horn, opening said tubular element by protrusion of an inner tubular element and provide manual guidance to it into the curve of the horn and positioning the distal end of the inner tubular element near the ovary, and further providing semen nearby the ovary through an internal semen channel.

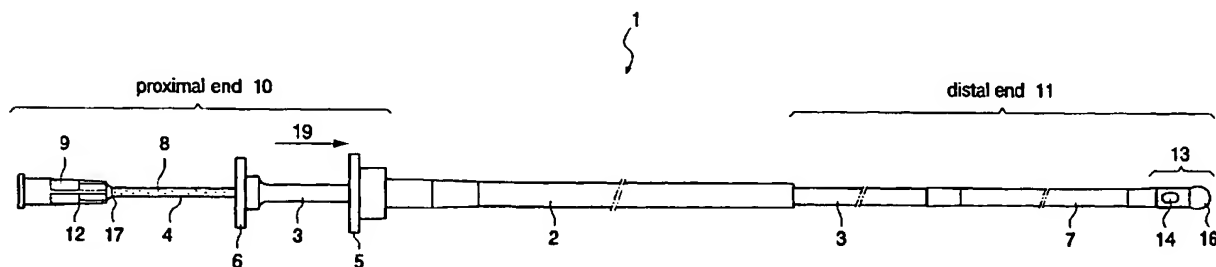


FIG. 1

**Description**

## Field of the Invention

- 5 **[0001]** The present invention relates to a method and a device for the artificial insemination of bovines and other animals.

## Description of Related Art

- 10 **[0002]** Worldwide, artificial insemination (AI) has penetrated about 80% of the dairy industry but only about 5% of the beef producing industry. One reason is the need for skilled personnel, veterinarians and technicians, trained to grasp the cervix via the rectum and to guide the AI pipette into or through the cervix.

- [0003]** In the traditional AI, the inseminator must insert the insemination tube into the cervix by developing the tactile skill to work through the wall of the large intestine while pushing the tube forward through the vagina with the other hand. The cervix is more than 10 cm long (10,16 - 15,24 cm in beef cattle) and often has several bends (e.g. "s" or "v" shape in some Brahman cattle), and has several very tight sphincters through which the AI tube must be guided. Hence there is the ever present danger of perforating the wall of the cervix or the uterus with the inseminating tube, causing injury to the animal. Because of these difficulties, it is often impossible to advance the inseminating tube very far into the cervix, with a corresponding lower insemination efficiency and conception success rate.

- 20 **[0004]** Several artificial insemination devices are known, for example as disclosed in US 6,071,231 and US 4,493,700.

- [0005]** An overview article on AI is found in Acta Vet. Scand. 1998, 39, 149-163 "Deep Uterine Insemination of Cattle: A fruitful Way Forward with Smaller Numbers of Spermatozoa" by Hunter and Greve. As in the present invention the importance of the site of fertilization and of spermatozoa deposition, i.e. near the utero-tubal junction is explained.

- 25 **[0006]** While these devices and methods have been a great advancement in artificial insemination, reducing time, expenses and effort, and increasing effectiveness, there are still a number of problems.

- [0007]** The major disadvantage of the deposition of the semen at the posterior end of the uterus is the great loss (about 60%) of the inseminated semen. Only about 40% of the insemination remains in the female genital tract and only 0.1% of this reaches the place of fertilization in the oviduct.

- 30 **[0008]** One problem is that these devices do not deliver the optimum quantity and concentration of semen that will maximize the probability of conception since there is no way to assure that all of the semen is transferred from its storage straw into the uterus of the animal without any losses.

- [0009]** Another problem is that these devices do not simplify the deliverance of the optimum total charge of semen and diluting fluid required to accommodate the cervixes and uteri of animals of varying sizes since there is no way to vary the total charge while preserving the optimum quantity and concentration of semen.

- 35 **[0010]** Due to the extreme curvature of the uterine horn when a cow is in oestrus, deposition of semen is normally performed in the cranial part of the cervix or in the uterine body. Seldom, the semen is deposited in the major curve of the uterine body. The distance of the ejected semen towards the mature ovum in the oviduct remains considerable and results in a lower insemination efficiency and conception success rate. In contrast to pigs, in cows normally only one oocyte per cycle ovulates unless they are hormonally treated for superovulation. Because cattle is a monovular species, it is very important that the semen is present in the top of the uterine horn at the site of ovulation. Because palpation of the ovaries often causes rupture of the mature follicle and loss of the oocyte in the abdomen, the side of the ovulation is usually not determined during insemination. This means that a lot of sperm is needed to establish fertilization in one of both oviducts, at the side of ovulation if the semen is deposited at the caudal end of the uterus.

- 45 **[0011]** The article "Fertilization rates in superovulating cows after deposition of semen on the infundibulum, near the uterotubal junction or after insemination with high numbers of sperm" in Theriogenology (May 1998, Vol. 29, No. 5, p1131-1142), Hawk et al. describes a method and device comprising three pieces of non-standard equipment for insemination at the uterotubal junction consisting of:

- 50 a) a stainless steel tube 60 cm long, 6.3 mm outside diameter and 4.4 mm inside diameter for penetrating the cervix;  
b) a flexible teflon tube (TFS No. 9<sup>d</sup>) 90 cm long and 4 mm outside diameter for passing through the uterine horns;  
and  
c) a nylon rod 105 cm long to expel semen from the teflon tube. A round epoxy bead was formed around one end of the teflon tube to facilitate passing the tube through the uterine horns. Two cotton plugs with polyvinyl-chloride powder between them were inserted into the end of the teflon tube adjacent to the epoxy bead and there was a 1 ml air space between the plugs and the end of the tube. The nylon rod was marked to permit expulsion of semen in 0.5 ml quantities. Although this device is an improvement on site of deposition of the semen in the uterine horn, this device requires the use of cotton plugs and nylon rods which need to be manipulated by at least two skilled
- 55

people.

[0012] According to the method disclosed by Hawk in the above-mentioned publication, semen is housed in a tube which is partly closed at one end and closed with cotton plugs on the other end. A syringe fitted with a length of tygon tubing was used to transfer 1 ml of the semen into the teflon insemination tube. The teflon tube is then inserted into the stainless steel sheath, so that the epoxy bead was seated into one end of the steel tube. The use of such a tube is only possible in a recti-linear manner. It is impossible to move the cotton plugs and the polyvinyl chloride forward through the teflon tube if it makes a sharp curvature of the contractile uterus of a cow.

[0013] Semen is lost at various steps of the operation. Some semen is left behind in the storage tube when it is mixed with the diluting fluid in the ampule. Some semen is also left behind in the ampule when the semen mixed with diluting fluid is aspirated into the pipette. And finally, some semen is left behind in the pipette when the semen mixed with diluting fluid and loaded in the pipette is pushed with air or a nylon rod out of the pipette.

[0014] These losses of semen produce an inseminating fluid charge with a low sperm concentration and a corresponding low fertilization success rate. In addition, the total charge of semen and diluting fluid cannot be readily adjusted to accommodate the various size cervixes and uteruses found among animals of different sizes, breeds and species. Thus an insemination device with an improved ability of delivering an optimum quantity and concentration of semen, and that lends itself to delivering an optimum total charge of semen and diluting fluid, is desirable.

#### SUMMARY OF THE INVENTION

[0015] Accordingly it is an object of the invention to provide an artificial insemination (AI) device and method for bovines and other animals with improved semen delivery.

[0016] It is also an object of the invention to provide an AI device and method, which deliver the optimum quantity and concentration of semen.

[0017] It is another object to deliver the optimum of quantity of semen near or as close as possible near the utero-tubal junction (UTJ), where fertilization takes place.

[0018] It is another object of the invention to provide an AI device and method, which deliver an optimum total charge of semen and diluting fluid.

[0019] It is a further object of the invention to provide an AI device and method, which will optimize the fertilization success rate regardless of the decreased sperm quality and the varying sizes of the animals.

[0020] It is another object to provide an AI device and method providing an improved delivery site for the semen near the utero-tubal junction.

[0021] Another important object of the invention is to deposit the semen as close to the fertilization place as possible, avoiding contamination of the uterine environment.

[0022] It is another object to inseminate as close as possible to the place of fertilization without causing damage to the uterine mucosa, and certainly without perforating the uterine wall. Herefore a flexible top is necessary.

[0023] It is another object of the invention to provide a method and device that can be adapted to other animals and for other compounds.

[0024] A final important object of the invention is to develop an insemination instrument and technique, which prevents spreading of venereal diseases (Bovine Viral Diarrhoea, Bovine Herpesvirus-1, Campylobacter Foetus) from one cow to the other in or between different livestock.

[0025] The AI device according to the invention comprises an artificial insemination device for the insemination of bovine and other animals comprising three hollow and essentially cylindrical tubular elements, each element is provided with an open proximal and an open distal end, said three elements being:

- an outer protective sheath,
- an inner sheath and a semen tube, and
- a semen tube,

whereby the diameter of said elements is such that the inner sheath is axial movably in the outer protective sheath and the semen tube is axial movably in the inner sheath and whereby the length of the outer sheath is less than the length of the inner sheath.

[0026] The use of an inner and an outer sheath makes it possible to provide an improved positioning of the distal end of the AI device according to the invention. The use of three elements results in a suitable site of deposition for the semen, i.e. near the utero-tubal junction. This suitable deposition site is obtained into two steps. First by positioning the distal end of the outer sheath through the cervix in the vagina close to the uterine wall and then in a second positioning via the protrusion of at least a part of the inner sheath through the outer sheath for obtaining a position near the UTJ of the distal end. The second positioning step is preferably controlled by manual guidance of the distal

end of the protruded part of the inner sheath. Once in a suitable position near the utero-tubal junction semen is ejected. This semen deposition is performed without any spoilage due to the fact that the semen tube is a separate element housed in the inner sheath. The semen is forced out of the semen tube only when it is in a suitable deposition site. The distal end of the semen tube is enclosed in the inner sheath. Preferably the distal end of the semen tube is in a frictional contact with the inner wall of the inner sheath. When the inner sheath protrudes through the outer sheath, the semen tube will - passively - follow the movement of the inner sheath.

**[0027]** In a preferred embodiment an artificial insemination is provided wherein the inner sheath comprises at least a rigid part and a flexible part. The use of said flexible part provides an advantage, i.e. has the possibility of following the curvature of the uterine horn without damaging the uterine wall. In a preferred embodiment the distal end (introduced in the cervix and uterus) of the flexible part is provided with a cervix protector element having an ejection port for the ejection of semen and having closure means for closing off the outer sheath. Provided with said cervix protector element the introduction of the outer sheath can be performed without any harm to the cervix of the bovine to be inseminated.

**[0028]** More preferred embodiments of the present invention are disclosed in sub-claims 5-15 and will be elucidated with reference to the drawings.

**[0029]** The invention is also related to a method for the insemination of bovines and other elements. The method according to the invention comprises two position steps for positioning the distal end of a AI device is performed in two separate positioning steps. In a first step the position of a rigid tubular element, the outer sheath is performed through the cervix into the uterus. In a second positioning step a second tubular element having a smaller diameter, the inner sheath is further positioned via protrusion through the outer sheath into the uterine horn near the ovum. If necessary, manual guidance of the distal end of the inner sheath can assist the positioning of the distal end. When a suitable position of the distal end is obtained semen can be ejected. All these manipulations can be performed by one person, the inseminator.

#### BRIEF DESCRIPTION OF THE DRAWINGS

**[0030]** Further features and advantages of the invention will be apparent from the ensuing description which is given merely by way of example with reference to accompanying drawings in which:

FIG. 1 shows an overview of an entire artificial insemination assembly according to the invention, the three parts are interrupted in the direction of its length, it being understood that, at the scale at which it is represented, this length would be distinctly greater than the length of the drawing sheet, and

FIG. 2a and 2b show cross sectional views of the proximal and distal end respectively of an artificial insemination assembly according to the invention.

#### DETAILED DESCRIPTION OF THE INVENTION

**[0031]** The entire artificial insemination assembly 1 essentially comprises three hollow cylindrical open or semi-open tubular elements, which are each axial movably in a sliding motion mounted in one another. These three elements are: an outer protective sheath 2 for the penetration of the cervix, an inner sheath 3 and the semen tube 4. The diameter of those three elements is such that the semen tube, having the smallest diameter, is axial movable in the inner sheath 3, and the inner sheath is axial movably in the outer sheath 2. The outer sheath 2 has a length which is smaller than the length of the inner sheath 3.

**[0032]** The proximal end 10 of the AI device 1 is the end which protrudes out of the bovine during insemination and at which end external manual handling is performed. The distal end 11 of the AI device 1 is the end which takes position in the reproductive organ of the bovine when insemination is performed.

**[0033]** The outer sheath has a rigid cylindrical form and is sealable via the cervix protector element 10. The cervix protector element 10 is attached at the distal end of the inner sheath 3. In a suitable position of the inner sheath 3 the cervix protector element 10 closes the outer sheath 2. A closed outer sheath 2 carrying the inner sheath 3 and the semen tube 4 is introducable through the anterior vagina, the cervix in a recti-linear movement, up to a position when the distal end of the inner sheath makes contact with the uterine wall.

**[0034]** The inner sheath 3 is axial movable mounted in the outer sheath 2 and has at its proximal end, a small annular handling disc or thumb rest 5 which permits shifting the inner sheath by means of the thumb of the user into a position touching the finger flange 6 of the outer protective sheath 2. This sliding action results in a protrusion of a flexible part 7 of the inner sheath 3 into the uterine horn. Manipulation by hand will guide said flexible part 7 around the major curve of the uterine horn and position the distal end

near the UTJ. Semen 8 in the semen tube can at this position be delivered nearby the UTJ.

**[0035]** The inner sheath 3 has a tubular body which is adapted to receive at one end a supply of semen contained

in an open semen tube 4.

[0036] The inner sheath 3 is provided with cervix protector means 13 for protecting the cervix of the bovine. Said cervix protector means 13 will further close off the outer sheath 2 thereby preventing entrance of uterine contents and assuring no spoilage of any semen (closing off the semen tube) and not harmful when introduced (closing off the outer sheath). When positioning the flexible part 7 of the inner sheath 3 the cervix protector means 13 guide the semen 8 through an inner channel 15 and ejection port 14. The cervix protector has a smooth end 16. The tube containing the semen is totally free of toxic components that could be harmful to cells. The top of the inner sheath is a round enlarged top, from which the inner diameter decreases to the top. This prevents loss of semen between the insemination tube and the inner sheath.

[0037] The path of the flexible part of the inner sheath in the uterine lumen can be followed through the wall of the large intestine by rectal palpation. The exact positioning of the semen deposition can be located by palpating the cervix protector element of the inner sheath.

[0038] For hygienic reasons the AI device according to the invention is preferably made of disposable materials, for single use only. As an example hereunder dimensions and materials are listed for each element in table 1.

[0039] The proximal end 10 of the inner sheath 3 prevents that the inner sheath 3 could come out of the outer sheath 2. The tube 4, containing the semen 8 is inserted in the inner sheath 3 and is fixed into the inner sheath 3 by means of an increase of the outer diameter, caused by the insertion of a needle 21 in the tube 4. This needle 21 also provides a good fixation of the syringe on the tube 4 and into the inner sheath 3. The cervix protector element of the inner sheath 3 closes the inner and outer sheath, so that no dirt can enter the instrument when it is inserted into the female genital tract. This prevents contamination of the uterine environment and semen.

[0040] The semen tube 4 is made out of a flexible material and is provided with adaptor means 9 at its proximal end 10. These adaptor means 9 comprise in the depicted embodiment a needle hub (LuerLock®-coupling 12) for housing a syringe. This syringe will force the semen 8 in and out the semen tube 4.

[0041] The semen tube 4 is axial movably mounted in the inner sheath 3. The adaptor means 9 could be a syringe or a plunger-rod adapted to expel the semen from the tube and prior to the insemination to suck up the semen from a semen container. The semen tube has a total volume within a range of 1-0.25 ml and preferably from about 0,5 ml.

[0042] Semen of a chosen bull (Cassou straw of 0.25 ml) is normally preserved in a closed container with liquid nitrogen. In the classic insemination technique, the straw is thawed and opened at one side and inserted in the insemination instrument. The semen is expelled by moving the cotton plugs forwarded by means of a stainless steel rod. For the insemination instrument according to the invention, no straws can be used. The straws are first thawed at 37°C during one minute and then the semen (0.25 ml) is then expelled in an ampule which contains 0.25 ml sodium citrate. The total of 0.5 ml is sufficient for a successful insemination by the deposition of 0.25 ml semen and dilution solution for each uterine horn.

[0043] The use of an open semen tube at the distal end is an advantage for the filling of the semen tube with the semen originating from a semen container. The use of a suction device, for example a syringe at the proximal end of the semen tube will force the semen out of the container into the semen tube. No semen is wasted in this way in the filling of the semen tube. As the semen tube is a separate element used in the AI device according to the invention and herein only serving for the transport deposition of semen in a site, which position fully controlled by the inner (and outer) sheath, also no semen is lost in the deposition, i.e. insemination step. Ejection of semen out of the semen tube through the distal end of the inner sheath (the cervix protection means 13) is also done under control of a pushing or forcing device, which can be a syringe. As it becomes apparent a syringe is a preferred tool for filling and emptying the semen tube. Semen can also be "pre-sexed" i.e. detected on the X or the Y sex chromosome, for example by the use of known techniques, such as flow cytometry or immunological techniques.

[0044] The inner 3 and outer 4 sheath is of the type having a thickness which is substantially constant throughout its length and having at a first open end, the proximal end or insemination end distal end.

[0045] Due to the slightly broadened frusto-conical element 17 at the overlap of the adaptor means 9 at the proximal end 10 of and the semen tube 4 it is possible to lock the semen tube 4 on the inner sheath 3. This rubbing contact, which is also a result of the widening of the diameter of the tube 4 by the insertion of the needle 21, between the element 17 and the annular opening 18 of the flange 5 will result in a combined axial movement of the tube 4 with the inner sheath 3. When pushing the thumb rest or finger flange 5 toward the finger flange 6 of the outer sheath 2 the semen tube will migrate along over the same distance or will retard a little.

[0046] Once the flexible part 7 of the inner sheath 3 protrudes through the outer sheath 2, the distal end of the semen tube will be forced to make the same sliding movement. The flexible part 7 of the inner sheath 3 can be manually guided into the uterine horn. When the distal end of the inner sheath 3 is close to the ovary a suitable semen deposition site is obtained. Optionally with a small extra axial push on the semen tube, the distal end 20 thereof will be guided into the inner channel 15 of the cervix protector means 13. With the same hand, which has performed the axial movement of the flanges (5,6) guide, an expelling instrument, such as preferable a syringe, the semen 8 is expelled out of the semen tube 4 through the ejection port 14 near the ovary. This is an important advantage of the present invention.

## EP 1 190 684 A1

One person only, i.e. the inseminator, can perform the insemination, using one arm and hand to guide the flexible part 7 of the inner sheath and the other for the control of the axial movement at the proximal end of the elements 2,3 and 4, and the control of the expelling instrument for expelling the semen out of the semen tube.

[0047] The insemination device according to the invention prevents damage to the sperm, caused by environmental factors (light, cold). It is not transparent and made of materials with a low heat conductivity. Light causes an increase of oxidation reactions and release of reactive oxygen species (ros) which causes membrane damage of the spermatozoa and death. A sudden decrease beneath 15°C causes a cold shock effect in the spermatozoa and death.

[0048] The insemination technique according to the invention makes it possible to use:

- lower numbers of spermatozoa in the inseminate
- frozen-thawed sperm cells that are especially vulnerable to passage along the full extent of the uterus
- sex-selected sperm cells ( X and Y chromosome bearing spermatozoa) available in relatively low numbers
- sperm cells whose DNA status may have been modified by specific treatment.

[0049] It should be clear that the present invention is not restricted to bovine nor to insemination of semen. Other animals, for example horses, deer, etc. can be treated in a similar way. Embryos, antibiotics and other compounds and compositions can also be delivered using the present device and method.

[0050] As a practical example preferred lengths and preferred materials of the components of the AI device are given in table I.

Table I:

Element	Length	Internal diameter	External diameter	Material
Outer sheath 2	50 cm	3.2 mm	5.5 mm	ABS
Inner sheath 3	55 cm	1.95 mm	3.0 mm	ABS
Outer flange 6	3.0 mm	3.10 mm	1.7 cm	PVC
Inner flange 5	3.0 mm	4.7 mm	1.7 cm	PVC
Cervix protection means			5.0 mm	ABS
Flexible part 7	16 cm	2.5 mm	3.0 mm	PVC
Semen tube 4	73 cm	1.0 mm	1.8 mm	PE

### Claims

1. An artificial insemination device for the insemination of bovines and other animals comprising three hollow and essentially cylindrical tubular elements, each element is provided with an open proximal and a open distal end, said three elements being:

an outer protective sheath,  
an inner sheath and a semen tube, and  
a semen tube,

whereby the diameter of said elements is such that the inner sheath is axial movably in the outer protective sheath and the semen tube is axial movably in the inner sheath, whereby the length of the outer sheath is less than the length of the inner sheath.

2. An artificial insemination device according to claim 1, wherein the inner sheath comprises at least a rigid part and a flexible part.
3. An artificial insemination device according to claim 2, wherein the inner sheath comprises a rigid part near its proximal end and a flexible part near its distal end, both parts are axially interconnected forming a passage for the semen tube.
4. An artificial insemination device according to claim 1, 2 or 3, wherein the flexible part at its distal end is provided with cervix protector element having an ejection port for the ejection of semen and closure means for closing off the outer sheath.

**EP 1 190 684 A1**

5. An artificial insemination device according to claim 1, 2, 3 or 4, wherein the flexible part has a length from 1 cm to 40cm, preferably from 5 to 30cm and more preferably from 10 to 20 cm.
6. An artificial insemination device according to any of the previous claims 1-5, wherein the inner sheath is provided at its proximal end with a small handling disc.
7. An artificial insemination device according to any of the previous claims 1-6; whereby the outer sheath is provided at its proximal end with a finger flange.
8. An artificial insemination device according to any of the previous claims 1-7, whereby the length of the outer sheath is from 40-60 cm and preferably from 45-55cm.
9. An artificial insemination device according to any of the previous claims 1-8, whereby the two sheaths are made of a disposable material, for example a synthetic plastic.
10. An artificial insemination device according to any of the previous claims 1-9, wherein the semen tube is flexible.
11. An artificial insemination device according to any of the previous claims 1-10, whereby the semen tube is provided with adaptor means for coupling of a semen expelling instrument.
12. An artificial insemination device according to claim 11, whereby the adaptor means are formed by a needle hub for a syringe as a semen expelling instrument.
13. Outer sheath for use in an AI device according to any of the claims 1-12, comprising a cylindrical tubular body with an open distal end and an open proximal end, and provided with a finger flange at the proximal end having a length of 40-60 cm and made out of rigid disposable material.
14. Inner sheath for use in an AI device according to any of the claims 1-12, comprising a cylindrical tubular hollow body with an open proximal end and a at least partly open distal end provided with a finger flange at the proximal end having a first rigid part having a length of 20-60 cm and a second flexible part having a length of 5-30 cm and made out of a disposable material.
15. Semen tube for use in an AI device according to any of the claims 1-12, comprising a cylindrical tubular hollow body made out of a flexible and disposable material with an open distal end and at the proximal end provided with adaptor means, for example a LuerLock® for a syringe.
16. Method for the insemination of bovines and other animals, comprising the steps of inserting through the cervix and into the uterine horn, a closed tubular element to a point near the major curve of the horn, opening said tubular element by protrusion of an inner tubular element and provide manual guidance to it into the curve of the horn and positioning the distal end of the inner tubular element near the ovary, and further providing semen nearby the ovary through an internal semen channel.
17. Method according to claim 16, wherein the protrusion of the inner element is performed once the outer sheath has been introduced through the cervix.
18. Method according to claim 16 or 17, wherein semen is expelled once the distal end of the inner sheath has been positioned near the utero-tubal junction.
19. Method for insemination of a bovine whereby the inseminator uses one hand to guide the distal end of an AI device while his second hand is used to manipulate the proximal end of the AI device.
20. Method for insemination of a bovine according to claim 19, whereby his second hand is used to control a semen expelling device.

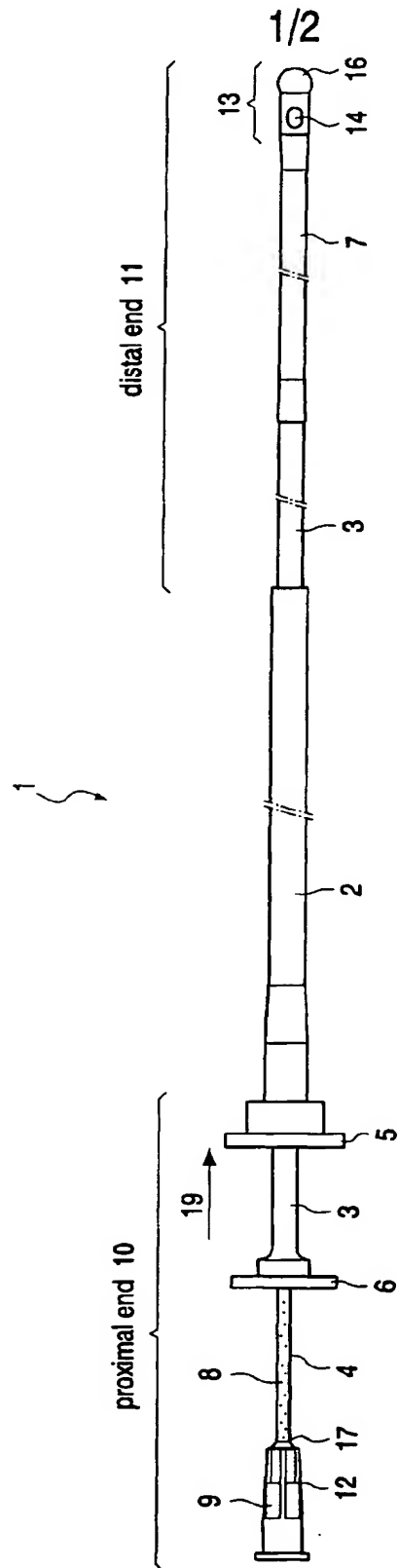


FIG. 1



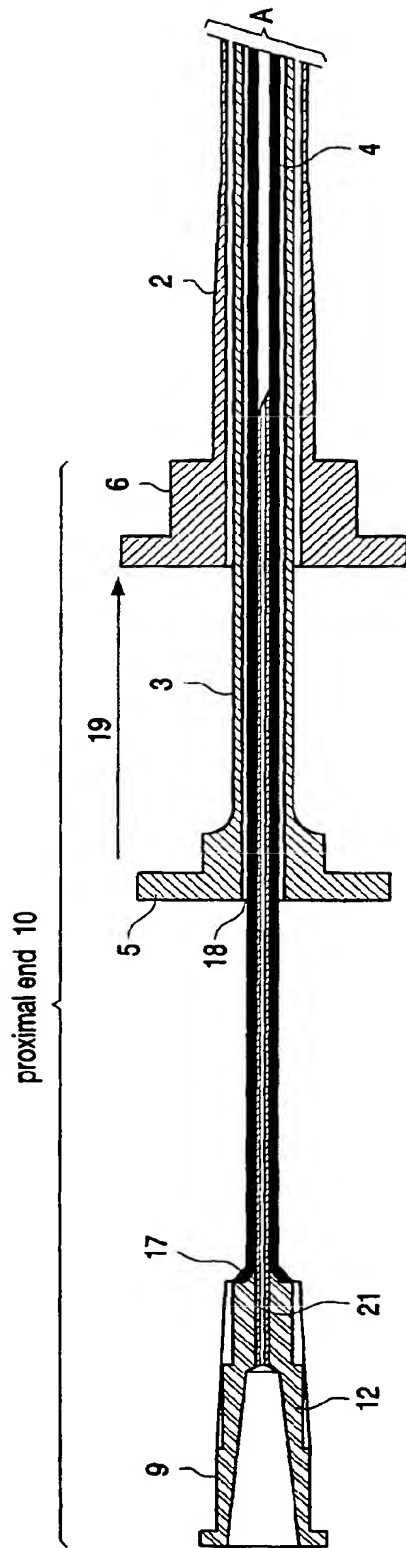


FIG. 2A

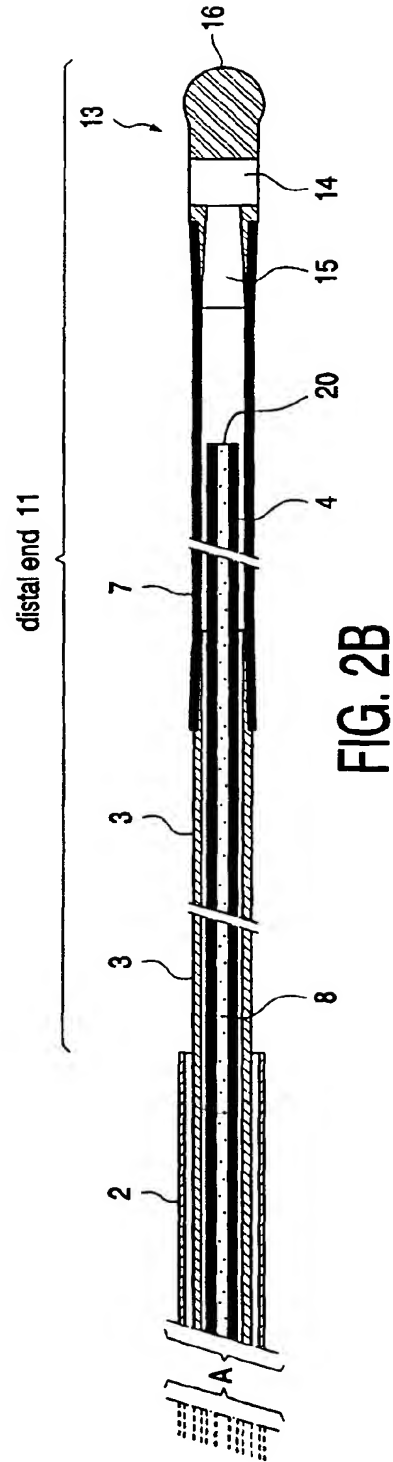


FIG. 2B



European Patent  
Office

# PARTIAL EUROPEAN SEARCH REPORT

Application Number

which under Rule 45 of the European Patent Convention EP 00 87 0190 shall be considered, for the purposes of subsequent proceedings, as the European search report

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (InCL.7)
X	US 5 496 272 A (CHUNG BYUNG H ET AL) 5 March 1996 (1996-03-05)	1-3,5-7, 9,11,14, 19,20 4	A61D19/02
Y	* column 3, line 65 - column 6, line 6 * * column 6, line 62 - column 7, line 42 * * column 8, line 20-54 * * column 10, line 28 - column 12, line 22 * * column 13, line 14 - column 14, line 53 * * figures 1-25 *		
Y	FR 2 647 668 A (MEDIZIN LABORTECHNIK VEB K) 7 December 1990 (1990-12-07) * page 3, line 6-14 * * page 5, line 10 - page 7, line 8 *	4	
X	US 5 916 144 A (PRATHER RANDALL S ET AL) 29 June 1999 (1999-06-29) * column 2, line 10-65 * * column 4, line 33 - column 5, line 37 * * column 10, line 17 - column 13, line 34 * * figures 1-46 *	1,6-13, 15,19,20	
			TECHNICAL FIELDS SEARCHED (InCL.7)
			A61D A61B
<b>INCOMPLETE SEARCH</b> The Search Division considers that the present application, or one or more of its claims, does/do not comply with the EPC to such an extent that a meaningful search into the state of the art cannot be carried out, or can only be carried out partially, for these claims. Claims searched completely : 1-15, 19-20 Claims searched incompletely :  Claims not searched : 16-18 Reason for the limitation of the search: Article 52 (4) EPC - Method for treatment of the human or animal body by surgery			
Place of search <b>THE HAGUE</b>		Date of completion of the search <b>9 February 2001</b>	Examiner <b>Salvignol, A</b>
<b>CATEGORY OF CITED DOCUMENTS</b> X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

EPO FORM 1503 03/82 (P04C07)



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## PARTIAL EUROPEAN SEARCH REPORT

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EP 00 87 0190

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
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